

WHAT IS CLAIMED:

- 5 1. A powder blend for use in a laser sintering process comprising a steel alloy selected from the group consisting of a mild steel alloy, a carbon steel and a stainless steel, a polymeric binder and a high melting temperature fine particulate.
2. The powder blend according to claim 1 wherein the steel alloy ranges in size from less than about 90 microns to about 4 microns.
3. The powder blend according to claim 2 wherein the steel alloy ranges in size from less than about 75 microns to about 8 microns.
4. The powder blend according to claim 2 wherein the steel alloy is less than about 45 microns.
5. The powder blend according to claim 1 wherein the steel alloy is spherical.
6. The powder blend according to claim 2 wherein the high melting temperature fine particulate has a particle size less than about 10 microns.
7. The powder blend according to claim 6 wherein the high melting temperature fine particulate has a particle size less than about 2 microns.
8. The powder blend according to claim 7 wherein the high melting temperature fine particulate comprises greater than about 5 weight percent and less than about 15 weight percent of the powder blend.
9. The powder blend according to claim 8 wherein the high melting temperature fine particulate comprises about 8 weight percent of the powder blend.

10. The powder blend according to claim 1 wherein the polymeric binder is a thermoplastic or a thermoset.

11. The powder blend according to claim 1 wherein the polymeric binder is selected from the group consisting of polyethylene, polypropylene, polyacetal, polymethacrylate, polyvinylacetate, nylon, wax, phenolic and combinations thereof.

12. The powder blend according to claim 11 wherein the polymeric binder is nylon.

13. The powder blend according to claim 12 wherein the nylon is one selected from the group consisting of polymers and co-polymers of nylon 6, nylon 9, nylon 10, nylon 11, and nylon 12.

14. The powder blend according to claim 1 further comprising a flow agent.

15. The powder blend according to claim 14 wherein the flow agent is fumed silica.

16. A method of forming a tough, strong, wear-resistant, corrosion-resistant, infiltrated metal product comprising the steps of:

a. mixing together a powder blend comprising a steel alloy selected from the group consisting of a mild steel alloy, a carbon steel and a stainless steel, a polymeric binder and a high melting temperature fine particulate;

b. applying a layer of the powder blend to a working surface in a laser sintering system;

c. exposing the layer of the powder blend to heat energy to fuse together the steel alloy and high melting temperature fine particulate by the melting and subsequent rehardening of the binder material;

d. applying a new layer of powder blend and exposing the new layer of powder blend in sequential fashion repeatedly until a three-dimensional green metal part is formed; and

- 15 e. infiltrating a green metal part with metal infiltrant in a gas atmosphere at
an effective temperature for an effective time period.
17. The method according to claim 16 wherein using a powder blend comprising
about 88.75 to about 92.75 weight percent mild steel alloy;
about 6 to about 9 percent tungsten carbide, and
about 1.25 to about 2.25 weight percent polymer binder.
- 5 18. The method according to claim 16 further comprising using copper and/or copper
containing alloys as a metal infiltrant.
19. The method according to claim 18 further comprising using a gas selected from
the group consisting of nitrogen, argon, or a nitrogen argon blend as the gas
atmosphere during infiltration.
20. The method according to claim 19 using nitrogen as the gas atmosphere during
infiltration.
21. The method according to claim 19 further comprising performing the infiltrating
using an infiltration cycle having a peak temperature of about 1070°C.
22. The method according to claim 16 further comprising exposing the infiltrated
green metal part to a heat treatment cycle.
23. The method according to claims 20 further comprising using a fine grit alumina
packing medium as a support material to encase the green metal part during infiltration.
24. The method according to claim 17 further comprising using a powder blend
having about 8 weight percent high melting temperature fine particulate,
about 1.6 to about 2.1 weight percent nylon binder, and
the remainder a mild steel alloy.

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25. The method according to claim 24 further comprising deagglomerating the mild steel alloy to a range in size from less than about 90 microns to about 4 microns.

26. The method according to claim 24 further comprising deagglomerating the mild steel alloy to a range in size from less than about 75 microns to about 8 microns.

27. The method according to claim 25 further comprising deagglomerating the high melting temperature fine particulate.

28. The method according to claim 27 further comprising using a high melting temperature fine particulate having a particle size less than about 10 microns.

29. The method according to claim 22 further comprising performing the heat treatment cycle having a peak temperature of about 840°C for at least one hour, quenching the infiltrated part with room temperature nitrogen to reduce the part temperature over an effective time, sub-cooling the part to about -79° C over at least a
5 90 minute period, return the part to room temperature, and temper the part for about 3 hours at about 163° C.

30. The method according to claim 16 further comprising prior to infiltrating, absorbing nitrogen into a mild steel alloy in the green metal part.

31. The method according to claim 30 further comprising prior to infiltrating, maintaining the green metal part at a temperature in excess of about 850° C and less than about 900° C for about 4 to about 6 hours in a nitrogen atmosphere.

5 32. The powder blend according to claim 9 wherein the high melting temperature fine particulate is tungsten carbide.

33. The method according to claim 28 further comprising using tungsten carbide as the high melting temperature fine particulate.

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